WHAT IS CLAIMED IS:

1.    A channel estimation device comprising:

weighting factor generating means for generating
weighting factors for weighting and averaging pilot
symbols, which are time multiplexed with a control channel,
which is parallel multiplexed with a data channel; and

channel estimation value calculating means for
weighting and averaging said pilot symbols using said
weighting factors and calculating a channel estimation
value of data symbols of said data channel.

2.    The channel estimation device as claimed in claim 1,
wherein said weighting factor generating means generates
weighting factors to be used for weighting and averaging
mean values of the pilot symbols in a plurality of slots
of said control channel, and said channel estimation value
calculating means weights and averages the mean values of
said pilot symbols using said weighting factors and
calculates the channel estimation value of the data symbols
of said data channel.

3.    The channel estimation device as claimed in claim 1
or 2, wherein said weighting factors are determined
according to the positions of said pilot symbols in the
slots of said control channel.

4.    The channel estimation device as claimed in any one
of claims 1-3, wherein said weighting factor generating
means divides the data symbols in the slots of said data
channel into a plurality of data symbol sections, selects
5    the pilot symbols appropriate for calculating the channel
estimation value of the data symbols in each of the data
symbol sections, and generates the weighting factors to
be used for weighting and averaging the pilot symbols; and
said channel estimation value calculating means takes
10    weighted average of said pilot symbols using said weighting
factors and calculates the channel estimation value of the
data symbols of each of the data symbol sections.

5.    The channel estimation device as claimed in claim 4,
15    wherein in order to calculate the channel estimation value
of the data symbols of the last data symbol section of the
i-th (i: integer) slot and to calculate the channel
estimation value of the data symbols of the first data
symbol section of the (i+1)-th slot, said weighting factor
20    generating means selects the same pilot symbol and
generates the weighting factors to be used for weighting
and averaging the pilot symbols.

6.    The channel estimation device as claimed in any one
25    of claims 1-5, further comprising:
        fading frequency decision means for deciding the
fading frequency based on an inner product value of said

pilot symbols; and

factor altering means for altering the factors that are used in taking said weighted average according to the fading frequency decided by said fading frequency decision means.

7.     The channel estimation device as claimed in any one of claims 1-6, wherein a transmission rate of said data channel differs from the transmission rate of said control channel.

8.     A demodulation device comprising:

weighting factor generating means for generating weighting factors to be used for weighting and averaging pilot symbols being time multiplexed in a control channel that was parallel multiplexed together with a data channel;

channel estimation value calculating means for weighting and averaging said pilot symbols using said weighting factors and for calculating a channel estimation value of data symbols of said data channel; and

channel variation compensating means for compensating channel variation of said data symbols using the channel estimation value calculated by said channel estimation value calculating means.

9.     A fading frequency decision device comprising:

inner product value calculating means for

calculating an inner product value of pilot symbols, which
are time multiplexed with a control channel, which is
parallel multiplexed with a data channel; and

decision means for deciding a fading frequency based
5   on the inner product value calculated by said inner product
value calculating means.


10.   The fading frequency decision device as claimed in
claim 9, wherein
10       said inner product value calculating means
comprises:

normalizing means for normalizing mean values
of the pilot symbols in each of two slots of said control
channel;
15       inner product value calculation executing
means for calculating an inner product value of the mean
values of the two pilot symbols normalized by said
normalizing means; and

inner product value averaging means for
20  averaging inner product values calculated by said inner
product value calculation executing means over a plurality
of slots of said control channel, and

said decision means comprises

decision executing means for deciding the
25   fading frequency by comparing the inner product value
averaged by said inner product value averaging means and
a threshold value.

11.    The fading frequency decision device as claimed in claim 10, wherein, when the inner product value averaged by said inner product value averaging means is larger than a certain constant value, said fading frequency decision device performs said normalizing, said inner product value calculation, and said inner product value averaging on mean values of the pilot symbols in each of two slots having a farther interval in said control channel, and decides the fading frequency by comparing the averaged inner product value so obtained and a threshold value corresponding to said farther interval.

12.    The fading frequency decision device as claimed in claim 9, wherein

said inner product value calculating means comprises:

normalizing means for normalizing the mean values of the pilot symbols in each of two slots of said control channel with respect to each of multipath signals to be used for RAKE combining;

inner product value calculation executing means for calculating the inner product value of the mean values of the two pilot symbols normalized by said normalizing means with respect to each of said multipath signals;

first inner product value averaging means for

averaging the inner product values of each of said multipath signals calculated by said inner product value calculation executing means; and

second inner product value averaging means for averaging the inner product values averaged by said first inner product value averaging means over a plurality of slots of said control channel, and

said decision means comprises

decision executing means for deciding the fading frequency by comparing the inner product value averaged by said second inner product value averaging means and a threshold value.

13.    The fading frequency decision device as claimed in claim 12, wherein, when the inner product value averaged by said second inner product value averaging means is larger than a certain constant value, said fading frequency decision device performs said normalizing, said inner product value calculation, averaging of the inner product values of each of said multipath signals, and averaging of the inner product values over said plurality of slots on the mean values of the pilot symbols in each of two slots having a farther interval in said control channel, and decides the fading frequency by comparing the averaged inner product value so obtained and a threshold value corresponding to said farther interval.

14.    The fading frequency decision device as claimed in
claim 9, wherein

said inner product value calculating means
comprises:

5              normalizing means for normalizing the mean
values of the pilot symbols in each of two slots in said
control channel;

inner product value calculation executing
means for calculating the inner product value of the mean
10    values of the two pilot symbols normalized by said
normalizing means for two or more cases with varying inner
product measuring interval; and

inner product value averaging means for
averaging the inner product value calculated by said inner
15    product value calculation executing means over a plurality
of slots of said control channel with respect to each of
the inner product measuring intervals, and

said decision means comprises
decision executing means for deciding the
20    fading frequency using the inner product value for each
of the inner product measuring intervals averaged by said
inner product value averaging means.


15.    The fading frequency decision device as claimed in
25    claim 14, further comprising difference calculating means
for calculating the difference of the inner product values
for two inner product measuring intervals averaged by said

inner product value averaging means, wherein said decision executing means decides the fading frequency using also the difference calculated by said difference calculating means.

5

16. The fading frequency decision device as claimed in claim 9, wherein

said inner product value calculating means comprises:

10    normalizing means for normalizing mean values of the pilot symbols in each of two slots in said control channel with respect to each of multipath signals to be used for RAKE combining;

inner product value calculation executing

15 means for calculating the inner product value of the mean values of the two pilot symbols normalized by said normalizing means for two or more cases with varying inner product measuring interval with respect to each of said multipath signals;

20    first inner product value averaging means for averaging the inner product values of each of said multipath signals calculated by said inner product value calculation executing means with respect to each of the inner product measuring intervals; and

25    second inner product value averaging means for averaging the inner product values averaged by said first inner product value averaging means over a plurality of

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slots of said control channel with respect to each of the inner product measuring intervals, and

said decision means comprises

decision executing means for deciding the fading frequency using the inner product value for each of the inner product measuring intervals averaged by said second inner product value averaging means.

17. The fading frequency decision device as claimed in claim 16, further comprising difference calculating means for calculating the difference of the inner product values for two inner product measuring intervals averaged by said second inner product value averaging means, wherein said decision executing means decides the fading frequency using also the difference calculated by said difference calculating means.

18. A channel estimation device for calculating a channel estimation value of data symbols using pilot symbols in a channel in which said data symbols and said pilot symbols are time multiplexed, said channel estimation device comprising:

weighting factor generating means for dividing data symbols in a slot of said channel into a plurality of data symbol intervals, selecting pilot symbols suitable for calculation of a channel estimation value of data symbols during each data symbol interval and generating weighting

factors for weighting and averaging said pilot symbols; and

channel estimation value calculating means for weighting and averaging said pilot symbols using said weighting factors and calculating a channel estimation value of data symbols during each data symbol interval.

19. The channel estimation device as claimed in claim 18, wherein in order to calculate the channel estimation value of the data symbols in the last data symbol section in the i-th (i: integer) slot and to calculate the channel estimation value of the data symbols of the first data symbol section in the (i+1)-th slot, said weighting factor generating means selects the same pilot symbol and generates the weighting factors to be used for weighting and averaging said pilot symbols.

20. The channel estimation device as claimed in claim 18 or 19, wherein said weighting factor generating means generates the weighting factors to be used for weighting and averaging mean values of the pilot symbols for each of the plurality of slots of said channel, and said channel estimation value calculating means takes weighted average of the mean values of said pilot symbols using said weighting factors and calculates the channel estimation value of the data symbols in each of the data symbol sections.

21.    The channel estimation device as claimed in any one
of claims 18-20, wherein said weighting factors are
determined according to positions of said pilot symbols
in the slots of said channel.


22.    The channel estimation device as claimed in any one
of claims 18-21, further comprising:

fading frequency decision means for deciding the
fading frequency based on the inner product value of said
pilot symbols; and

factor altering means for altering the factors to
be used for taking said weighted averaging according to
the fading frequency decided by said fading frequency
decision means.


23.    A demodulation device comprising:

weighting factor generating means for dividing
data symbols in the slots of a channel into which the data
symbols and pilot symbols are time multiplexed into a
plurality of data symbol sections, selecting pilot symbols
appropriate for calculating the channel estimation value
of the data symbols in each of the data symbol sections,
and generating the weighting factors to be used for
weighting and averaging said pilot symbols;

channel estimation value calculating means for
weighting and averaging said pilot symbols using said

weighting factors and calculating the channel estimation
value of the data symbols in each of data symbol sections;
and

5 channel variation compensating means for
compensating channel variation of said data symbols using
the channel estimation value calculated by said channel
estimation value calculating means.


24. A fading frequency decision device comprising:

10 inner product value calculating means for
calculating an inner product value of pilot symbols in a
channel in which data symbols and said pilot symbols are
time multiplexed; and

decision means for deciding a fading frequency based
15 on the inner product value calculated by said inner product
value calculating means.


25. The fading frequency decision device as claimed in
claim 24, wherein

20 said inner product value calculating means
comprises:

normalizing means for normalizing mean values
of the pilot symbols in each of two slots of said channel;

inner product value calculation executing
25 means for calculating the inner product value of the mean
values of the two pilot symbols normalized by said
normalizing means; and

inner product value averaging means for averaging the inner product values calculated by said inner product value calculation executing means over a plurality of slots of the said channel, and

5          said decision means comprises

decision executing means for deciding the fading frequency by comparing the inner product value averaged by said inner product value averaging means and a threshold value.

10

26.     The fading frequency decision device as clamed in claim 25, wherein, when the inner product value averaged by said inner product value averaging means is larger than a certain constant value, said fading frequency decision

15  device performs said normalizing, said inner product value calculation, and said inner product value averaging on mean values of the pilot symbols in each of two slots having a farther interval in said control channel, and decides the fading frequency by comparing the averaged inner

20  product value so obtained and a threshold value corresponding to said farther interval.

27.     The fading frequency decision device as claimed in claim 24, wherein

25          said inner product value calculating means comprises:

normalizing means for normalizing mean values

of the pilot symbols in each of two slots of said control

channel with respect to each of multipath signals to be

used for RAKE combining;

inner product value calculation executing

5　means for calculating the inner product value of the mean

values of the two pilot symbols normalized by said

normalizing means with respect to each of said multipath

signals;

first inner product value averaging means for

10　averaging the inner product values of each of said

multipath signals calculated by said inner product value

calculation executing means; and

second inner product value averaging means for

averaging the inner product values averaged by said first

15　inner product value averaging means over a plurality of

slots of said channel, and

said decision means comprises

decision executing means for deciding the

fading frequency by comparing the inner product value

20　averaged by said second inner product value averaging means

and a threshold value.


28.　The fading frequency decision device as claimed in

claim 27, wherein, when the inner product value averaged

25　by said second inner product value averaging means is

larger than a certain constant value, said fading frequency

decision device performs said normalizing, said inner

product value calculation, averaging of the inner product

values of each of said multipath signals, and averaging

of the inner product values over said plurality of slots

on the mean values of the pilot symbols in each of two slots

5    having a farther interval in said control channel, and

decides the fading frequency by comparing the averaged

inner product value so obtained and a threshold value

corresponding to said farther interval.


10    29.    The fading frequency decision device as claimed in

claim 24, wherein

        said inner product value calculating means

comprises:

            normalizing means for normalizing the mean

15    values of the pilot symbols in each of two slots of said

channel;

            inner product value calculation executing

means for calculating the inner product value of the mean

values of the two pilot symbols normalized by said

20    normalizing means for two or more cases with varying inner

product measuring interval; and

            inner product value averaging means for

averaging the inner product values calculated by said inner

product value calculation executing means over a plurality

25    of slots of said control channel with respect to each of

the inner product measuring intervals, and

        said decision means comprises

decision executing means for deciding the fading frequency using the inner product value for each of the inner product measuring intervals averaged by said inner product value averaging means.

5

30.    The fading frequency decision device as claimed in claim 29, further comprising difference calculating means for calculating the difference of the inner product values for two inner product measuring intervals averaged

10    by said inner product value averaging means, wherein said decision executing means decides the fading frequency also using the difference calculated by said difference calculating means.

15    31.    The fading frequency decision device as claimed in claim 24, wherein

said inner product value calculating means comprises:

normalizing means for normalizing mean values

20    of the pilot symbols in each of two slots of said channel with respect to each of multipath signals to be used for RAKE combination;

inner product value calculation executing means for calculating the inner product value of the mean

25    values of two pilot symbols normalized by said normalizing means for two or more cases with varying inner product measuring interval with respect to each of said multipath

signals;

first inner product value averaging means for averaging the inner product value of each of said multipath signals calculated by said inner product value calculation executing means with respect to each of the inner product measuring intervals; and

second inner product value averaging means for averaging the inner product values averaged by said first inner product value averaging means over a plurality of slots of said control channel with respect to each of the inner product measuring intervals, and

said decision means comprises

decision executing means for deciding the fading frequency using the inner product value for each of the inner product measuring intervals averaged by said second inner product value averaging means.

32. The fading frequency decision device as claimed in claim 31, further comprising difference calculating means for calculating the difference of the inner product values for two inner product measuring intervals averaged by said second inner product value averaging means, wherein said decision executing means decides the fading frequency also using the difference calculated by said difference calculating means.

33. A channel estimation device that calculates a channel

estimation value of data symbols of a data channel using
pilot symbols of a pilot channel which is parallel
multiplexed with said data channel, said channel
estimation device comprising:

5      weighting factor generating means for dividing data
symbols in said channel into a plurality of data symbol
intervals, selecting pilot symbols suitable for
calculation of a channel estimation value of data symbols
during each data symbol interval and generating weighting
10   factors for weighting and averaging said pilot symbols;
and

channel estimation value calculating means for
weighting and averaging said pilot symbols using said
weighting factors and calculating a channel estimation
15   value of data symbols during each data symbol interval.

34.   The channel estimation device as claimed in claim 33,
wherein said weighting factor generating means generates
the weighting factors to be used for weighting and
20   averaging mean values of the pilot symbols in each of a
plurality of sections in said pilot channel, and said
channel estimation value calculating means takes weighted
average of the mean values of said pilot symbols using said
weighting factors and calculates the channel estimation
25   value of the data symbols in each of the data symbol
sections.

35.    The channel estimation device as claimed in claim 33 or 34, further comprising:

   fading frequency decision means for deciding the fading frequency based on the inner product value of said pilot symbols; and

   factor altering means for altering the factors to be used for taking said weighted average according to the fading frequency decided by said fading frequency decision means.

36.    The channel estimation device as claimed in any one of claims 33-35, wherein a transmission rate of said data channel differs from the transmission rate of said pilot channel.

37.    A demodulation device comprising:

   weighting factor generating means for dividing data symbols of a data channel into a plurality of data symbol sections, selecting pilot symbols of a pilot channel that was parallel multiplexed together with said data channel, appropriate for calculating the channel estimation value of the data symbols in each of the data symbol sections, and generating weighting factors to be used for weighting and averaging the pilot symbols;

   channel estimation value calculating means for weighting and averaging said pilot symbols using said weighting factors and calculating the channel estimation

value of the data symbols of each of the data symbol sections; and

channel variation compensating means for compensating the channel variation of said data symbols using the channel estimation value calculated by said channel estimation value calculating means.

38.  A fading frequency decision device comprising:

inner product value calculating means for calculating an inner product value of pilot symbols in a pilot channel which is parallel multiplexed with a data channel; and

decision means for deciding a fading frequency based on the inner product value calculated by said inner product value calculating means.

39.  The fading frequency decision device as claimed in claim 38, wherein

said inner product value calculating means comprises:

normalizing means for normalizing the mean value of the pilot symbols in each of two sections of said pilot channel;

inner product value calculation executing means for calculating an inner product value of mean values of the two pilot symbols normalized by said normalizing means; and

inner product value averaging means for

averaging the inner product values calculated by said inner

product value calculation executing means over a plurality

of sections of said channel, and

5        said decision means comprises

decision executing means for deciding the

fading frequency by comparing the inner product value

averaged by said inner product value averaging means and

a threshold value.

10

40.    The fading frequency decision device as claimed in

claim 39, wherein, when the inner product value averaged

by said inner product value averaging means is larger than

a certain constant value, said frequency decision device

15  performs said normalizing, said inner product value

calculation, and said averaging of the inner product values

with respect to the mean values of the pilot symbols in

each of two sections having a farther interval in said pilot

channel, and decides the fading frequency by comparing the

20  averaged inner product value so obtained and a threshold

value corresponding to the farther interval.

41.    The fading frequency decision device as claimed in

claim 38, wherein

25        said inner product value calculating means

comprises:

normalizing means for normalizing the mean

values of the pilot symbols in each of the two sections
of said pilot channel with respect to each of multipath
signals to be used for RAKE combining;

inner product value calculation executing
means for calculating the inner product value of the mean
values of the two pilot symbols normalized by said
normalizing means with respect to each of said multipath
signals;

first inner product value averaging means for
averaging the inner product values of respective paths of
said multipath calculated by said inner product value
calculation executing means; and

second inner product value averaging means for
averaging the inner product values averaged by said first
inner product value averaging means over a plurality of
sections of said pilot channel, and

said decision means comprises

decision executing means for deciding the
fading frequency by comparing the inner product value
averaged by said second inner product value averaging means
and a threshold value.

42.    The fading frequency decision device as claimed in
claim 41, wherein, when the inner product value averaged
by said second inner product value averaging means is
larger than a certain constant value, said fading frequency
decision device performs said normalizing, said inner

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product value calculation, averaging of the inner product values of each of said multipath signals, and averaging of the inner product values over said plurality of sections with respect to the mean values of the pilot symbols in

5    each of two sections having a farther interval in said pilot channel, and decides the fading frequency by comparing the averaged inner product value so obtained and a threshold value corresponding to said farther interval.

10   43.    The fading frequency decision device as claimed in claim 38, wherein

said inner product value calculating means comprises:

normalizing means for normalizing the mean

15   values of the pilot symbols in each of the two sections of said pilot channel;

inner product value calculation executing means for calculating the inner product value of the mean values of the two pilot symbols normalized by said

20   normalizing means for two or more cases with varying inner product measuring interval; and

inner product value averaging means for averaging the inner product vales calculated by said inner product value calculation executing means over a plurality

25   of sections of said control channel with respect to each of the inner product measuring intervals, and

said decision means comprises

fading frequency decision means for deciding the fading frequency using the inner product value for each of the inner product measuring intervals averaged by said inner product value averaging means.

5

44. The fading frequency decision device as claimed in claim 43, further comprising difference calculating means for calculating the difference of the inner product values for the two inner product measuring intervals averaged by

10 said inner product value averaging means, wherein said decision executing means decides the fading frequency using also the difference calculated by said difference calculating means.

15 45. The fading frequency decision device as claimed in claim 38, wherein

said inner product value calculating means comprises:

normalizing means for normalizing the mean

20 values of the pilot symbols in each of the two sections of said pilot channel with respect to each of multipath signals to be used for RAKE combining;

inner product value calculation executing means for calculating the inner product value of the mean

25 values of the two pilot symbols normalized by said normalizing means for two or more cases with varying inner product measuring interval with respect to each of said

multipath signals;

first inner product value averaging means for
averaging the inner product value for each path of said
multipath calculated by said inner product value
5  calculation executing means with respect to each of the
inner product measuring intervals; and

second inner product value averaging means for
averaging the inner product values averaged by said first
inner product value averaging means for a plurality of
10  sections of said control channel with respect to each of
the inner product measuring intervals, and

said decision means comprises

decision executing means for deciding the
fading frequency using the inner product value for each
15  of the inner product measuring intervals averaged by said
second inner product value averaging means.

46.  The fading frequency decision device as claimed in
claim 45, further comprising difference calculating means
20  for calculating the difference of the inner product values
for two inner product intervals averaged by said second
inner product value averaging means, wherein said decision
executing means decides the fading frequency also using
the difference calculated by said difference calculating
25  means.

47.  A method for estimating a channel, comprising the

steps of:

generating weighting factors to be used for weighting and averaging pilot symbols being time multiplexed in a control channel that was parallel multiplexed together
5    with a data channel; and

averaging said pilot symbols using said weighting factors and calculating a channel estimation value of data symbols of said data channel.

10   48.   A method for deciding the fading frequency, comprising the steps of:

calculating an inner product value of pilot symbols being time multiplexed in a control channel that was parallel multiplexed together with a data channel; and
15       deciding the fading frequency based on said inner product value.

49.   A channel estimation method for calculating a channel estimation value of data symbols using pilot symbols in
20   a channel in which said data symbols and pilot symbols are time multiplexed, comprising the steps of:

dividing the data symbols in the slots of said channel into a plurality of data symbol sections, selecting the pilot symbols appropriate for acquiring the channel
25   estimation value of the data symbols in each of the data symbol sections, and generating weighting factors to be used for weighting and averaging the pilot symbols; and

weighting and averaging said pilot symbols using said

weighting factors and calculating the channel estimation

value of the data symbols in each of the data symbol

sections.

5

50.    A method for deciding the fading frequency,

comprising the step of:

calculating an inner product value of pilot symbols

in a channel in which data symbols and pilot symbols are

10   time multiplexed; and

deciding the fading frequency based on said inner

product value.

51.    A channel estimation method for calculating a channel

15   estimation value of data symbols of a data channel using

pilot symbols of a pilot channel that was parallel

multiplexed together with said data channel, comprising

the steps of:

dividing the data symbols of said data channel into

20   a plurality of data symbol sections, selecting pilot

symbols appropriate for calculating the channel estimation

value of the data symbols in each of the data symbol

sections, and generating weighting factors to be used for

weighting and averaging the pilot symbols; and

25     weighting and averaging said pilot symbols using said

weighting factors and calculating the channel estimation

value of the data symbols in each of the data symbol

sections.

52. A method for deciding the fading frequency, wherein the fading frequency is decided based on an inner product value of pilot symbols of a pilot channel that was parallel multiplexed together with a data channel.

53. A demodulation device comprising:

channel estimating means for deriving N (N is natural number greater than or equal to two) in number of channel estimation values by weighted averaging of pilot signals in time using N in number of weighted sequences;

compensating means for compensating data sequences using said respective channel estimation values;

RAKE combining means for RAKE combining respective of said N data sequences after compensation; and

reliability judgment means for selecting one data sequence having highest reliability from said N data sequences after RAKE combination.

54. A demodulation device comprising:

channel estimating means for deriving N (N is natural number greater than or equal to two) in number of channel estimation values by weighted averaging of pilot signal in time using N in number of weighted sequences for data sequences of predetermined frame number;

compensating means for compensating data sequence

using said respective channel estimation values;

RAKE combining means for RAKE combining of said N data sequences after compensation; and

reliability judgment means for selecting N' (N':
natural number, N' < N) in number of weighting sequences from said N data sequence after RAKE combining and selecting one data sequence having the highest reliability from N data sequences,

selection of said N' weighting sequences being performed per a predetermined period, for remaining data sequences until performing said reliability judgement again said channel estimation means deriving N' channel estimation value by weighted averaging in time using N' weighting sequences, said compensating means compensating data sequences using N' channel estimation values, said RAKE combining means RAKE combining respective of N' data sequences after compensation, and said reliability judgment means selecting one data sequence having the highest reliability from said N' data sequences.

55. The demodulation device as claimed in claim 53 or 54, wherein said reliability judging means for judging reliability of said data sequence comprises:
error-correction decoding means for performing error-correction decoding of the data sequence after said RAKE combination;

CRC (Cyclic Redundancy Check) bit extracting means

for extracting CRC bits added to said data sequence;
CRC decoding means for decoding the CRC for said data
sequence;

frame error detecting means for detecting the
5 presence or absence of a frame error based on a decoding
result of said CRC;

number-of-frame-error counting means for counting
said number of the frame errors in a previously-determined
measuring time; and

10 weight sequence and data selecting means for
selecting the weight sequence having high reliability and
the data sequence that is demodulated using the weight
sequence so selected based on said counting result of the
frame errors.

15

56. The demodulation device as claimed in claim 53 or 54,
wherein said reliability judging means for judging
reliability of the data sequence comprises:

error-correction decoding means for performing
20 error-correction decoding of the data sequence after said
RAKE combination;

likelihood information extracting means for
extracting likelihood information that is calculated when
performing the error-correction decoding of each of the
25 data sequences;

likelihood averaging means for averaging said
extracted likelihood information for a previously-

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determined measuring time; and

weight sequence and data selecting means for selecting the weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said averaged likelihood information.

57. The demodulation device as claimed in claim 53 or 54, wherein said reliability judging means for judging reliability of the data sequence comprises:

electric power calculating means for calculating electric power of each of the data sequences after said RAKE combination;

electric power averaging means for averaging said calculation result of the electric power for a previously-determined measuring time; and

weight sequence and data selecting means for selecting the weight sequence having high reliability and data sequence that is demodulated using the weight sequence so selected based on said averaged electric power.

58. The demodulation device as claimed in claim 53 or 54, wherein said reliability judging means for judging reliability of the data sequence comprises:

signal-to-noise ratio(ratio of a signal power to a noise power) calculating means for calculating a signal-to-noise ratio  of each of the data sequences after

said RAKE combination;

signal-to-noise ratio averaging means for averaging the calculation result of said signal-to-noise ratio for a previously-determined measuring time; and

5          weight sequence and data selecting means for selecting the weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said averaged signal-to-noise ratio.

10

59.    The demodulation device as claimed in claim 53 or 54, wherein said reliability judging means for judging reliability of the data sequence comprises:

error-correction decoding means for performing
15    error-correction decoding of the data sequence after said RAKE combination;

CRC bit extracting means for extracting CRC bits added to said data sequence;

CRC decoding means for decoding the CRC for said
20    data sequence;

frame error detecting means for detecting the presence or absence of a frame error based on a decoding result of said CRC;

number-of-frame-error counting means for counting
25    the number of said frame errors in a previously-determined measuring time;

likelihood information extracting means for

extracting likelihood information that is calculated when performing error-correction decoding of each of the data sequences;

likelihood averaging means for averaging said extracted likelihood information for a previously-determined measuring time; and

weight sequence and data selecting means for selecting the weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said counted number of frame errors of the plurality of data sequences and said averaged likelihood information.

60.   The demodulation device as claimed in claim 53 or 54, wherein said reliability judging means for judging reliability of the data sequence comprises:

error-correction decoding means for performing error-correction decoding of the data sequence after said RAKE combination;

CRC bit extracting means for extracting CRC bits added to said data sequence;
CRC decoding means for decoding the CRC for said data sequence;

frame error detecting means for detecting the presence or absence of a frame error based on a decoding result of said CRC;

number-of-frame-error counting means for counting

said number of the frame errors in a previously-determined measuring time;

electric power calculating means for calculating electric power of each of the data sequences after said RAKE combination;

electric power averaging means for averaging said calculation result of the electric power for a previously-determined measuring time; and

weight sequence and data selecting means for selecting the weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said number of frame errors and said averaged electric power.

61.    The demodulation device as claimed in claim 53 or 54, wherein said reliability judging means for judging reliability of the data sequence comprises:

error-correction decoding means for performing error-correction decoding of the data sequence after said RAKE combination;

CRC bit extracting means for extracting CRC bits added to said data sequence;
CRC decoding means for decoding the CRC for said data sequence;

frame error detecting means for detecting the presence or absence of a frame error based on a decoding result of said CRC;

number-of-frame-error counting means for counting said number of the frame errors in a previously-determined measuring time;

signal-to-noise ratio calculating means for

5  calculating a signal-to-noise ratio (ratio of a signal power to a noise power) of each of the data sequences after said RAKE combination;

signal-to-noise ratio averaging means for averaging the calculation result of said signal-to-noise

10  ratio for a previously-determined measuring time; and

weight sequence and data selecting means for selecting weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said number of frame errors and said

15  averaged signal-to-noise ratio.


62.  A demodulation device comprising:

channel estimating means for weighted averaging of reception pilot signal using a plurality of weighting

20  sequences and deriving a plurality of channel estimation values;

demodulating means for inputting data sequences and outputting a plurality of demodulated data sequences using said plurality of channel estimation values; and

25  reliability judging means for selecting one demodulated data by making judgment of reliability of said plurality of demodulated data sequences.

63.    The demodulation device as claimed in claim 62, wherein

said reliability judging means comprises selecting

means for selecting predetermined number of the weight

sequences from among said plurality of weight sequences

based on a judgment result of reliability of said plurality

of demodulated data sequences, and

said demodulating means performs the demodulation

10  using only said predetermined number of the weight

sequences, when said predetermined number of the weight

sequences were selected.


64.    The demodulation device as claimed in any one of

15  claims ~~53-63~~ 53, 64 OR 62, wherein said pilot signals are time

multiplexed in a control channel that was parallel

multiplexed together with a data channel in which said data

sequence is contained.


20  65.    The demodulation device as claimed in any one of

claims 53-63, wherein said pilot signals are time

multiplexed in one channel together with said data

sequence.


25  66.    The demodulation device as described in claim 65,

wherein said channel estimating means divides the data

sequence in the slots of said channel into a plurality of

data sequence sections, selects pilot signals appropriate for calculating the channel estimation value of the data in each of the data sequence sections, and calculates the channel estimation value of the data of each of the data

5      sequence sections by weighting and averaging the selected pilot signals.

67.    The demodulation device as claimed in any one of claims 53-63, wherein said pilot signals are contained in

10    a pilot channel that was parallel multiplexed together with the data channel containing said data sequence.

68.    The demodulation device as claimed in claim 67, wherein said channel estimating means divides said data

15    sequence into a plurality of data sequence sections, selects pilot signals appropriate for calculating the channel estimation value of the data in each of the data sequence sections, and calculates the channel estimation value of the data in each of the data sequence sections

20    by weighting and averaging the selected pilot signals.

69.    A demodulation method comprising:

the step of obtaining N pieces of channel estimation values by time-weighting and averaging the pilot signals

25    using N (N: natural number greater than or equal to 2) sets of weight sequences;

the step of compensating data sequence using each

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of said channel estimation values;

the step of RAKE combining each of the N sets of the data sequences after said compensation; and

the reliability judgment step of selecting one set of the data sequences having the highest reliability from among the N sets of the data sequences after said RAKE combination.

70. A demodulation method comprising:

the step of obtaining N (N: natural number greater than or equal to 2) pieces of channel estimation values by time-weighting and averaging pilot signals using N sets of weight sequences with respect to a previously-determined number of frames of data sequence;

the step of compensating the data sequence using each of said channel estimation values;

the step of RAKE combining each of N sets of the data sequences after said compensation; and

the reliability judgment step of selecting N' (N': natural number; N'<N) sets of the weight sequences having high reliability from among said N sets of the data sequences after said RAKE combination and selecting one set of data sequence having the highest reliability from among the N sets of the data sequences after said RAKE combination,

wherein the selection of said N' sets of the weight sequences is conducted at regular intervals, and

throughout a period up to a time when said judgment of reliability is made next time, with respect to remaining part of the data sequence, in said step of estimating the channel, N' pieces of the channel estimation values are

5   obtained by time-weighting and averaging the data sequence using the N' sets of the weight sequences; in said step of compensating, the data sequence is compensated using the N' pieces of the channel estimation values; in said step of the RAKE combination, each of the N' sets of the

10  data sequences after the compensation is RAKE combined; and in said reliability judgment step, one set of the data sequence having the highest reliability is selected from among the N' sets of the data sequences.

15  71.    The demodulation method as claimed in claim 69 or 70, wherein said reliability judgment step comprises the steps of:
        error-correction decoding the data sequence after said RAKE combination;

20      extracting CRC bits added to said data sequence;
        decoding the CRC with respect to said data sequence;
        detecting the presence or absence of a frame error based on said demodulation result of the CRC;
        counting the number of said frame errors in a

25  previously-determined measuring time; and
        selecting the weight sequence having high reliability and the data sequence that is demodulated using

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the weight sequence so selected based on said counting result of the frame errors.

72.   The demodulation method as claimed in claim 69 or 70, wherein said reliability judgment step comprises the steps of:

error-correction decoding the data sequence after said RAKE combination;

extracting likelihood information calculated when performing error-correction decoding of each of the data sequence;

averaging said extracted likelihood information for a previously-determined measuring time; and

selecting the weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said averaged likelihood information.

73.   The demodulation method as claimed in claim 69 or 70, wherein said reliability judgment step comprises the steps of:

calculating electric power of each of the data sequences after said RAKE combination;

averaging the calculation result of said electric power for a previously-determined measuring time; and

selecting the weight sequence having high reliability and the data sequence that is demodulated using

the weight sequence so selected based on said averaged electric power.

74.    The demodulation method as claimed in claim 69 or 70,
5  wherein said reliability judgment step comprises the steps of:
        calculating a signal-to-noise ratio of each of the data sequences after said RAKE combination;
        averaging the calculation result of said
10  signal-to-noise ratios for a previously-determined measuring time; and
        selecting the weight sequence having high reliability and the data sequence that is demodulated using the weight sequence so selected based on said averaged
15  signal-to-noise ratio.

75.    The demodulation method as claimed in claim 69 or 70, wherein said reliability judgment step comprises the steps of:
20  performing error-correction decoding of the data sequences after said RAKE combination;
        extracting CRC bits added to said data sequence; decoding the CRC with respect to said data sequence;
        detecting the presence or absence of a frame error
25  based on said decoding result of the CRC;
        counting said number of the frame errors in a previously-determined measuring time;

extracting likelihood information that is
calculated when performing error-correction d decoding of
each of the data sequences;

averaging said extracted likelihood information
5   for a previously-determined measuring time; and

selecting the weight sequence having high
reliability and the data sequence that is demodulated using
the weight sequence so selected based on said measured
number of the frame errors of the plurality of the data
10   sequences and said averaged likelihood information.


76.    The demodulation method as claimed in either of claim
69 or 70, wherein said reliability judgment step comprises
the steps of:
15      error-correction decoding said data sequences
after said RAKE combination;

extracting CRC bits added to said data sequence;

decoding the CRC with respect to said data sequence;
detecting the presence or absence of a frame error based
20   on the decoding result of said CRC;

counting the number of said frame errors in a
previously-determined measuring time;

calculating electric power of each of received data
sequences after said RAKE combination;
25          averaging the calculation result of said electric
power for a previously-determined measuring time; and

selecting the weight sequence having high

reliability and the data sequence that is demodulated using the weight sequence so selected based on said number of frame errors and said averaged electric power.

5    77.    The demodulation method of as claimed in claim 69 or 70, wherein said reliability judgment step comprises the steps of:

error-correction decoding said data sequences after said RAKE combination;

10    extracting CRC bits added to said data sequence;

decoding the CRC with respect to said data sequence;

detecting the presence or absence of a frame error based on the decoding result of said CRC;

counting the number of said frame errors in a

15    previously-determined measuring time;

calculating a signal-to-noise ratio of each of the data sequences after said RAKE combination;

averaging calculation result of said signal-to-noise ratios for a previously-determined measuring time;

20    and

selecting the weight sequence having a high reliability and the data sequence that is demodulated with the weight sequence so selected based on the number of said frame errors and said averaged signal-to-noise ratio.

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78.    A demodulation method comprising the steps of:

weighting and averaging pilot signals using a

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plurality of weight sequences to obtain a plurality of channel estimation values;

deriving a plurality of demodulated data sequences from a data sequence using said plurality of channel
5 estimation values; and

selecting one output data sequence by making judgment of reliability of said plurality of demodulated data.

10 79. The demodulation method as claimed in claim 78, wherein, based on the judgment result of reliability of said plurality of demodulated data sequences, a predetermined number of weight sequences are selected from among said plurality of weight sequences, and after the
15 selection, demodulation through the use of only the selected weight sequences is performed.

80. The demodulation method as claimed in any one of claims 69-79, wherein said pilot signals are time
20 multiplexed into a control channel that is parallel multiplexed together with the data channel in which said data sequence is contained.

81. The demodulation method as claimed in any one of claims 69-79, wherein said pilot signals are time
25 multiplexed into one channel together with said data sequence.

82.    The demodulation method as claimed in claim 81,
wherein said step of estimating a channel divides said data
sequence in the slots of said channel into a plurality of
5    data sequence sections, selects pilot signals appropriate
for calculating the channel estimation value of the data
of each of the data sequence sections, and calculates a
channel estimation value of the data of each of the data
sequence sections by weighting and averaging the selected
10    pilot signals.


83.    The demodulation method as claimed in any one of
claims 69, 70 or 78, wherein said pilot signals are contained in
a pilot channel that was parallel multiplexed together with
15    the data channel containing said data sequence.


84.    The demodulation method as claimed in claim 83,
wherein said step of estimating a channel divides said data
sequence into a plurality of data sequence sections,
20    selects pilot signals appropriate for calculating the
channel estimation value of the data in each of the data
sequence sections, and calculates the channel estimation
value of the data of each of the data sequence sections
by weighting and averaging the selected pilot signals.